What Is Claimed Is:

1. A polymer gel patterning element for patterning biological materials.

2. A polymer gel contact mask.

3. The polymer gel contact mask of claim 1 wherein the polymer gel is a hydrogel.

4. The polymer gel contact mask of claim 3 wherein the hydrogel comprises polymer chains of polyHEMA.

5. The polymer gel contact mask of claim 4 wherein the polymer chains are substantially a homopolymer of HEMA crosslinked with a crosslinking agent.

6. The polymer gel contact mask of claim 5 wherein the crosslinking agent is a diacrylate or polyacrylate.

7. The polymer gel contact mask of claim 4 wherein the polymer chains are co-polymers of HEMA, a hydrophobic monomer and, optionally, a crosslinking agent.

8. The polymer gel contact mask of claim 4 wherein the polymer chains are block co-polymers of HEMA and a biodegradable polymer.

9. The polymer gel contact mask of claim 3 wherein the hydrogel is formed by polymerization of a polymer precursor composition comprising one or more chemically distinct monomer compounds and a crosslinking agent wherein the crosslinking agent is present in an amount of about 1 mole percent to about 5 percent with respect to the total monomer compound content.

10. A contact mask comprising a polymer gel having at least one hole therethrough.

11. The contact mask of claim 10 wherein the contact mask has a plurality of holes therethrough.

12. The contact mask of claim 10 wherein the hole ranges in size from approximately 1 μm^2

to approximately 100 mm^2.

13. The contact mask of claim 10 wherein the contact mask ranges from approximately 5 μm to approximately 3 mm in thickness.

14. The contact mask of claim 10 wherein the polymer gel is selected from the group consisting of poly(dimethylsiloxanes); poly(organosiloxanes); polyphosphazenes; polyurethanes; polyacrylates; polymethacrylates, poly(ethylene glycol), poly(ethylene glycol) acrylates, poly (vinyl alcohol), PEG-methacrylates, 2-(trimethoxysilyloxy)ethyl methacrylate, trimethoxysilyloxyl alkyl methacrylate, trimethoxy silyl alkyl methacrylate, polyvinylpyrrolidinone and carbohydrate-based hydrogel polymers, heparin, heparin sulfate, hyaluronic acid, polylactic acid, polybutadienes, hydrogels, and combinations thereof.

15. A polymer gel contact mask formed by complementary molding.

16. A mold for producing a hydrogel contact mask from a precursor composition, the mold comprising first and second half molds wherein the first half mold is made from an elastomer and deforms to accommodate dimensional changes in the precursor composition as it cures into a hydrogel.

17. The mold of claim 16 wherein the second half mold is made from an elastomer.

18. The mold of claim 16 wherein the second half mold is made from a thermoplastic.

19. The mold of claim 18 wherein the thermoplastic half mold is formed by thermal imprinting.

20. A mold comprising a half mold produced by thermal imprinting with an elastomeric master.

21. The mold of claim 20 wherein the master is made from a polyorganosiloxane,

22. The mold of claim 21 wherein the polysiloxane is polydimethylsiloxane.

23. A complementary mold comprising first and second half molds each having molding surfaces, wherein the molding surfaces define a void when the first and second half molds are closed and wherein at least one of the first or second half molds is an elastomer.

24. The complementary mold of claim 23 wherein the closed first and second half molds form a seal.

25. The complementary mold of claim 23 wherein the mold surface of one of the half molds has surface features.

26. The complementary mold of claim 23 wherein the mold surfaces of both of the half molds have surface features.

27. The complementary mold of claim 23 further comprising a release layer disposed between the first and second half molds.

28. The complementary mold of claim 23 further comprising a channel along an outer edge of a portion of one of the half molds.

29. The complementary mold of claim 23 wherein one of the half molds is made of a polymer selected from the group consisting of polydimethylsiloxane (PDMS), silicones, polyurethanes, polyphosphazenes, natural rubbers and synthetic rubbers.

30. The complementary mold of claim 23 wherein one of the half molds is selected from the group consisting of polyethylene, polypropylene, and Teflon.

31. A complementary mold comprising a PDMS half mold having a first molding surface, a release film adjacent to the first molding surface, and a rigid half mold having a second molding surface, wherein the first and second molding surfaces define a void.

32. A method of complementary molding comprising the steps of:

a) providing a complementary mold including first and second half molds each

having molding surfaces, wherein the molding surfaces define a void when the first and second half molds are closed and wherein at least one of the first or second half molds is an elastomer,

b) introducing a polymerizable precursor,

c) closing the half molds, and

d) polymerizing the molding precursor.

33. The method of claim 32 further comprising the step of separating the first and second half molds.

34. The method of claim 33 further comprising the step of removing the molded polymerized precursor from the half molds.

35. The method of claim 32 wherein one of the half molds is elastomeric.

36. The method of claim 32 further wherein one of the half molds has a release layer adjacent thereto.

37. The method of claim 32 wherein one of the half molds is made from a material selected from the group consisting of polydimethylsiloxane (PDMS), silicones, polyurethanes, polyphosphazenes, and latex rubber.

38. The method of claim 32 wherein one of the half molds is made from a material selected from the group consisting of polyethylene, polypropylene, and Teflon.

39. The method of claim 32 further comprising the step of applying pressure to the closed mold.

40. A method of complementary molding comprising the steps of:

a) providing a complementary mold including first and second half molds each having a molding surface, the molding surfaces defining a void there between, wherein

the half molds close to form a void, and wherein at least one of the first or second components is an elastomer,

b) closing the half molds to form a void,

c) introducing a polymerizable precursor into the void after the mold surfaces form the void, and

d) polymerizing the molding precursor.

41. A method of continuous complementary molding comprising the steps of

a) providing a first half mold including a plurality of first molding surfaces adapted and arranged for moving the molding surfaces from an unprocessed position to a processed position,

b) providing a second half mold having a second molding surface, wherein the first and second molding surfaces form a void there between when closed

c) applying polymerizable polymer precursor to one of the molding surfaces in the unprocessed position,

d) closing the half molds,

e) polymerizing the polymer precursor, and

f) moving the molded polymer to the processed position.

42. The method of claim 41 wherein at least one of the half molds is made from a material selected from the group consisting of polydimethylsiloxane (PDMS), silicones, polyurethanes, polyphosphazenes, and latex rubber.

43. The method of claim 41 wherein the one of the half molds is made from a material selected from the group consisting of polyethylene, polypropylene, and Teflon.

44. The method of claim 41 wherein a carrier film is disposed between the first and second

half molds.

45. The method of claim 41 further comprising the step of applying pressure to the first and second half molds after forming the void.

46. A method of thermal imprinting comprising the steps of:

a) providing an elastomeric master having a first imprinting surface and a elastomeric substrate having a second imprinting surface,

b) introducing a film having a lower glass transition temperature than the elastomeric master and the elastomeric substrate, between the elastomeric master and the elastomeric substrate,

c) heating the film to a temperature above the glass transition temperature of the film, and

d) cooling the film.

47. The method of claim 46 further comprising the step of separating the elastomeric master and elastomeric substrate.

48. The method of claim 46 wherein the first imprinting surface has features.

49. The method of claim 46 wherein the second imprinting surface has features.

50. The method of claim 46 wherein both the first and second imprinting surfaces have features.

51. The method of claim 46 further comprising the step of applying pressure to the elastomeric master and the elastomeric substrate with the film between them.

52. A method of forming a rigid complementary half mold comprising the steps of:

a) providing a first PDMS master having a first imprinting surface with surface features, providing a second PDMS substrate having a second imprinting surface,

b) providing a polyethylene film between the first and second imprinting surfaces,

c) applying pressure to the layered structure,

d) heating the layered structure above the glass transition temperature of the polyethylene, and

e) cooling the layered structure.

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